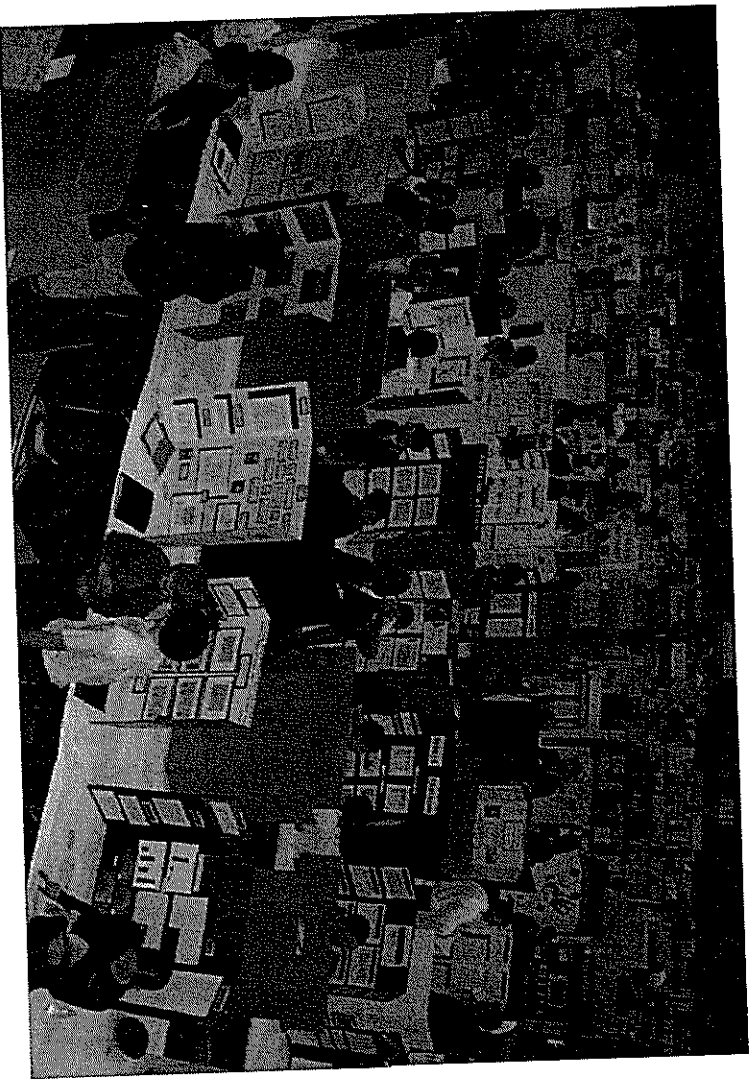


# **HESKETT MIDDLE SCHOOL**

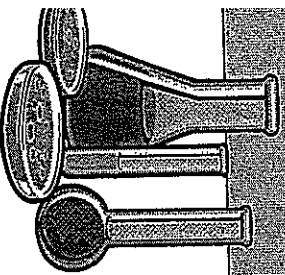


## **SCIENCE FAIR**

### **2011**

## Elements of a Successful Project

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for your student



Science is "a process by which we learn about the universe around us. Engineering is the application of knowledge toward some useful goal. A good science fair project includes the proper use of scientific and engineering ideas, such as the scientific method. The following steps will help you get started, and hopefully guide you to a well-rounded and winning science fair project. If you need help, don't be afraid to consult with a scientist or engineer that specializes in your field of study.

### STEP 1: Pick a Topic to Study

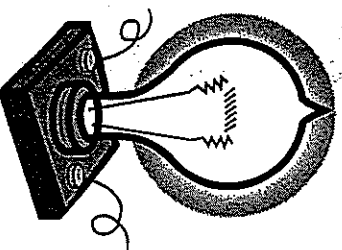
- Spend some time and give serious consideration to this part of your science fair project. Don't settle for a project that has been done before because it's easy. Originality tends to win over judges at **Hesket**. Pick a topic that grabs your interest and you want to learn more about.

### STEP 2: Do a Background Search

- While not the most exciting part of doing a science fair project, you will learn more about the topic that will provide you with the necessary information needed to come up with a hypothesis, appropriate methods to test your hypothesis, and allow you to draw conclusions about your results.
- This information will need to be included in your project report and science fair display.

### STEP 3: Formulate a Hypothesis or Goal

- A hypothesis is a sentence or two stating that, based on all the information you have to go on, this is what you truly believe will be the outcome of what you are going to test.
- A good hypothesis does not necessarily mean that it is a correct hypothesis. Frequently in science, a hypothesis may be disproved by the results of your experiments. This is not a flaw in your science fair project.
- Be sure your hypothesis can actually be tested within the confines of the timing and resources available to you and your science fair project.

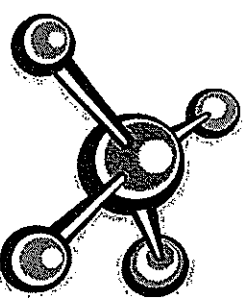


### STEP 4: Document Your Work (The Laboratory Notebook)

- One of the most important attributes of a good scientist is good record keeping. Doubt is a human trait so you need to be able to prove that what you found is correct and true. Do not rely on your memory.
- The lab notebook should contain all the procedures used in your experiments and all of the data that came from them. Both good results and bad results should be documented. Not every experiment works perfectly.
- Summaries, conclusions for each experiment should be written in your notebooks and any plans you may have for the next experiment. While it is easy to write too little in your lab notebook, you can never write too much.

### STEP 5: Design Experiments to Test Your Hypothesis (Methods)

- Experiments should test your hypothesis. Don't be afraid to design more than one experiment to test your hypothesis. Some of the best scientific designs test a hypothesis using more than one strategy.
- Be sure to include appropriate control groups for comparison.
- While it may seem labor intensive, test for only one thing in each of your experiments. For example: Do not change both the temperature and the nutrients for a bacteria culture in the same experiment. If you find a difference in the amount of bacteria produced in the culture, it won't be clear if it is due to the change in temperature or due to the change in the nutrients the culture was grown.



### STEP 6: Results

- This is the data generated from your experiments. It is best to repeat your experiments more than once to ensure reproducibility.
- SI units (grams, liters, meters, etc.) rather than English units (pounds, gallons, yards, etc.) are typically used in science. These units should be used whenever possible, although it will not count against you at **Hesket** if you use English units.

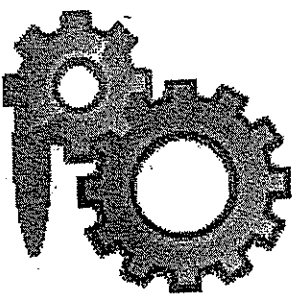
## Elements of a Successful Project (continued)

### EP 6: Results (continued)

- Statistics provide a quick summary of your data. Some commonly used statistics are the number of samples in each group ( $n$ ); an indicator for the mid-point of your groups (average); the range (minimum and maximum values); and an indication of the variability of the data (standard deviation or standard error of the mean).
- Statistical tests (such as t-tests and ANOVA) can be used to mathematically determine if the differences between your groups is a result of the treatment you imposed rather than it happened merely due to chance.

### EP 7: Evaluate Your Results and Strengthen Your Project

- Closely examine your data for any inconsistencies to fix, and any interesting findings.
- Take your project a step further. Many times the data you collect generates new questions to be answered. Most judges are impressed by second efforts.
- If your project has any short-comings in the experimental design, you may want to resolve these problems in a second effort, or at least be ready to discuss them.



### EP 8: Draw Conclusions

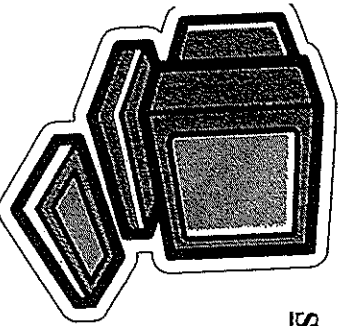
- Try to decipher what the information you have obtained from your data actually means. Sometimes there can be more than one answer. If your finding is very specific try to relate it back into the big picture.
- This section is also a good place to describe what future directions you would take your project.

### EP 9: Present Your Findings in a Research Paper

- A research paper is a formal written presentation of your science project. Good research papers are well-written (using proper sentence structure, correct spelling and punctuation, etc.), well-organized and contain all of the following items:
  - Introduction:** A paragraph or two that state your topic, your hypothesis, what you hope to achieve, and how you hope to achieve it.
  - Background:** A general introduction to the topic of study which includes the key findings or factors that lead you to what you decided to study.
  - Hypothesis:** A statement or two about what you believe will be the outcome of what you are testing.
  - Methods:** Describe in detail the protocol(s) used to test your hypothesis. A person reading your research paper should be able to repeat your experiments completely on the basis of what is written in this section.
  - Results:** Describe the data that you obtained from your experiments. In addition to the written text, photos, tables, figures and graphs are good ways to help present your data to the reader. Don't forget to express your data values using appropriate units of measure (examples: 1.29 cm or 5.8 mL, etc.)
  - Discussion:** Explain what your data means. State how your experiments and data support or refute your hypothesis. This section may be the longest and most important section of your paper!
  - Conclusion:** Was your hypothesis supported? Why or why not? What would you do differently? What would you do next?
  - Acknowledgements and References:** List the people and literature sources that assisted you with your project. Don't forget to thank any people or companies who donated time or supplies for your project.

### STEP 10: Present Your Findings in a Project Display

- For science and engineering fairs, you need to construct a display that shows off your project and all the components discussed above. Spend some time on this part of the process. It is your opportunity to showcase your hard work.
- The project display is a visual tool to communicate your project, and should be designed to explain your project in your absence.
- Make your display attractive and eye-catching to draw judges and passers-by to your project. Make a good first impression. You may not get a second chance.



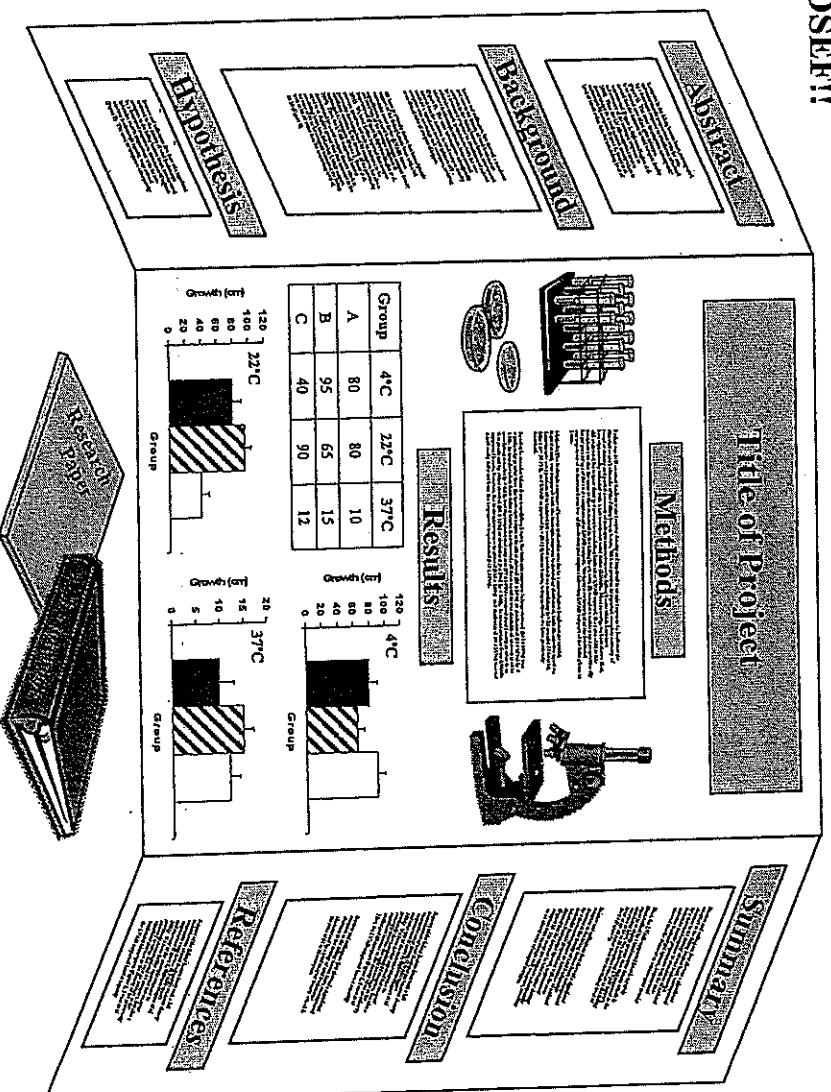
## Elements of a Successful Project (continued)

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### STEP 10: Presenting Your Findings in a Project Display (continued)

- Like a good research paper, a good project display should have all of the following:
  - Start with a good title. It may or may not be the same title as your research paper, but it should be displayed prominently.
  - Have text to summarize your project from start to finish. It is unlikely that you will be able to use all of the written text in your research paper on your display board. Select the most important points from each section to put on the board. You need enough information to convey your points, but don't overdo it. The text should be fairly large and easy to read. If possible, use a printer rather than writing by hand.
  - Have an organized flow of information. Your display can be organized like your research paper, but make sure the different sections are placed in a logical order around your display board.
  - Use photos, figures, tables and graphs to quickly illustrate your data. It is one of the easiest ways to convey your data.
  - Include any necessary display items, especially your laboratory notebook and research paper.

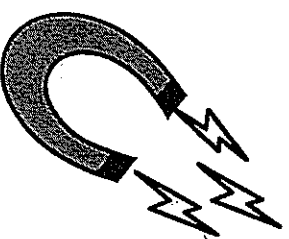
➔ **REVIEW PAGE 21 FOR ITEMS/PHOTOS NOT PERMITTED FOR DISPLAY AT NEOSEF!!**



**Please note:**  
This display  
is only an  
example.

### INFORMATION FOR ENGINEERING PROJECTS:

- Engineering projects follow a slightly different process, although it parallels the steps of the scientific method. Read through the steps for science projects, keeping in mind the goals of engineering projects defined below:
  - Identify a need. Be sure your idea is something that has a solution and is within your ability to construct.
  - Determine limits or other criteria that you must impose on your solution. Cost, materials, and time are all possible limiting criteria.
  - Do some preliminary research to see what's already been done to satisfy your need. This process may provide additional ideas.
  - Design something that you think will satisfy your need.
  - Build and test a prototype, refining or redoing if necessary.



## Category Descriptions

### Biological Science Categories



Biology: The study of living organisms, including the study of animals (zoology), plants (botany) and microorganisms (microbiology). Projects which should be entered into the biology category examine the structure, function, growth, origin, evolution and distribution of living things.



Health/Medicine: The study of health and disease in humans or animals, including disease diagnosis, causes of disease, ways of treating disease, medical procedures, alternative therapies for diseases, or the way in which the human or animal body functions normally.



Environmental Science: The study of the interactions among physical, chemical and biological components of the environment, including pollution (land, air and water), ecology, biodiversity, sustainability of the environment and causes of environmental degradation related to human activities.



Behavioral Science: The study of human and animal behavior through systematic observation and experimental intervention. Behavioral sciences investigate the decision processes and communication strategies within and between organisms in a social system.

### Physical Science Categories



Chemistry: The study of the nature and composition of matter and the laws governing it – physical chemistry, organic chemistry, inorganic chemistry, materials, plastics, fuels, pesticides, metallurgy, soil chemistry, food chemistry, etc.



Physics: The study of the universal laws that govern matter, energy, space and time, including solid state, optics, acoustics, particle, nuclear, atomic, plasma, superconductivity, fluid and gas dynamics, thermodynamics, semiconductors, magnetism, quantum mechanics and biophysics.



Math/Computer Science: The study of formal logical systems, patterns, and numeric computations, and the application mathematical principles to the world. The study and development of computer software and hardware and associated logical devices.



Earth/Space Science: The study of physical subjects related to the earth or space, including geology, mineralogy, physiography, oceanography, meteorology, climatology, astronomy, speleology, seismology and geography.



Engineering: The study of the application of scientific principles to manufacturing and other practical causes, including civil, mechanical, aeronautical, chemical, electrical, photographic, sound, automotive, marine, heating and refrigeration, and transportation engineering.

## Exhibit Rules and Regulations

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for your student

The following rules allow operations at ~~the~~**NEOSEP** to run smoothly and efficiently, ensure the safety of all persons in attendance, and reduce the risk of possible damage to your display. All projects will be inspected for adherence to these rules on set-up day at the fair and any projects with violations must be corrected prior to competition.

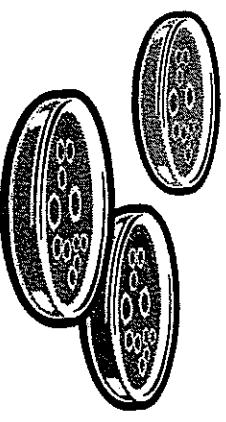
**Display Size:** The maximum display size is 40 in. wide, 108 in. high (including the table) and 30 in. deep.

### Display Rules/Regulations:

Many items are not permitted for display at ~~the~~**NEOSEP**. We recommended that you take pictures or draw schematics of important steps/results (see exceptions listed below) that you wish to convey to the judges. You may bring packaging from non-permitted items, but all packages must be empty. We also suggest using artificial items to substitute for those not permitted in the fair (examples: artificial plants or food).

#### Display items NOT permitted at NEOSEP include:

- Food of any kind
- Liquids of any kind (including water)
- Any living organism including plants, animals, bacteriological samples, etc.
- Human or animal parts or body fluids. (EXCEPTIONS: teeth, hair, nails, dried animal bones, histological dry mount sections, completely sealed wet mount slides)
- Soil or waste samples
- Dried plant material, unless sealed in acrylic or similar material
- Any household or industrial chemical, including water, toothpaste, soaps, detergents, motor oil, etc.
- Poisons, drugs, controlled substances, etc. (Even over-the-counter medications)
- Drying of any other sublimating solid
- Compressed gas tanks (including empty tanks)
- Flames or any highly-flammable material like gasoline, alcohol, etc.
- Weapons and sharp items like knives, syringes, scalpels, etc.
- Batteries with open-top cells
- Photographs that:
  - Depict animals in surgical techniques, dissections, necropsies, etc.
  - Identify human subjects that did not consent to being photographed
- Personal information of your human subjects, such as names, addresses, phone numbers, etc.
- Awards, medals, business cards, or other promotional materials not relevant to the project



## **Heskett Middle School Science Fair Information**

### **Display boards:**

Each student participating in the science fair will be given **one** display board to complete their project at no cost. The display boards may be picked up in the 8<sup>th</sup> grade service center on November 22<sup>nd</sup> and 23<sup>rd</sup> between the hours of 7:00 am to 4:00 pm. A responsible adult must be present to transport the board home. The boards will NOT be allowed on the bus as they could easily be damaged while transporting. Students are responsible for taking care of the board and transporting it back to school completed and intact.

### **Wiki:**

A wiki has been created in order for teachers and students to further communicate and share science fair resources. The address to the wiki is: <http://heskettsciencefair.wikispaces.com>. Students are encouraged to visit the wiki frequently to utilize the resources that will be provided for help with the science fair. Students will also find hyperlinks to useful websites on the wiki. These links will be especially helpful when picking a topic or performing background research. All handouts will also be posted to the wiki so students may print extra copies or view the material from a remote location.

### **Research Paper Guidelines:**

There is no length requirement as long as the paper meets the sectional requirements as outlined in the "Science Fair Packet". Remember to be very detailed in your paper and to include factual data as it is collected. The font to be used for the paper must be "Times New Roman" or "Arial" with a size 12 point font. Paragraphs are to be double spaced and pages must have a 1 inch margin on all sides. As this is a factual research paper it should be presented in a professional manner, please do not use colored ink or paper. Also, do not forget to cite references for your background research. For additional help on citing references see: <http://citationmachine.net>.



# Science Fair Project Rubric

Title of Project: \_\_\_\_\_

Author name: \_\_\_\_\_

<b>Display Board</b>	<b>40 pts.</b>
• Title	2 pts.
• Abstract	5 pts.
• Background	5 pts.
• Hypothesis	5 pts.
• Methods	5 pts.
• Results (should include photos, graphs, or tables)	5 pts.
• Summary	5 pts.
• Conclusion	5 pts.
• References	3 pts.
Total ____/40	
<b>Paper</b>	<b>40 pts.</b>
• Grammar, punctuation, spelling	3 pts.
• Abstract	5 pts.
• Background	5 pts.
• Hypothesis	5 pts.
• Methods	5 pts.
• Results	5 pts.
• Summary	5 pts.
• Conclusion	5 pts.
• References	2 pts.
Total ____/40	
<b>Lab Notebook</b>	<b>20 pts.</b>
• Should include all procedures and data	10 pts.
• Summaries and conclusions for each experiment	10 pts.
Total ____/20	
Project Total ____/100	



# **TIMELINE FOR PROJECT**

- NOVEMBER 4—PRESENTATION OF SCIENCE FAIR PROCESS
- NOVEMBER 5—INFORMATIONAL PACKETS AND CONTRACTS SENT HOME
- NOVEMBER 8—TOPIC CHOICE AND SCIENCE FAIR CONTRACT DUE
- NOVEMBER 12—CHECK POINT FOR DOCUMENTATION OF SCIENCE FAIR PROGRESS (LAB NOTEBOOK)
- NOVEMBER 19—CHECK POINT FOR DOCUMENTATION OF SCIENCE FAIR PROGRESS (LAB NOTEBOOK)
- NOVEMBER 23—CHECK POINT FOR DOCUMENTATION OF SCIENCE FAIR PROGRESS (LAB NOTEBOOK)
- DECEMBER 3—CHECK POINT FOR DOCUMENTATION OF SCIENCE FAIR PROGRESS (LAB NOTEBOOK)
- DECEMBER 10—CHECK POINT FOR DOCUMENTATION OF SCIENCE FAIR PROGRESS (LAB NOTEBOOK)
- DECEMBER 17—CHECK POINT FOR DOCUMENTATION OF SCIENCE FAIR PROGRESS (LAB NOTEBOOK)
- JANUARY 05—SCIENCE FAIR PROJECT DUE! (DISPLAY BOARD, RESEARCH PAPER, NOTEBOOK)
- JANUARY 20—MORNING SET-UP WITH HESKETT MIDDLE SCHOOL SCIENCE FAIR IN THE EVENING
- JANUARY 21—ALL SCHOOL SCIENCE FAIR IN THE GYMNASIUM

